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SEQUENCE LISTING

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<120> Novel method for the production of polyunsaturated fatty acids

<130> 13478-00001-US

<150> PCT/EP2003/014054  
<151> 2003-12-11

<150> GB 0229578.0  
<151> 2002-12-19

<150> GB 0316989.3  
<151> 2003-07-21

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<170> PatentIn version 3.3

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tac att aga aaa att ctt gaa aca atc ttc aca att ctt ttt gca ttc Tyr Ile Arg Lys Ile Leu Glu Thr Ile Phe Thr Ile Leu Phe Ala Phe 130 135 140	432
tac ctt caa tac cac aca tat tat ctt cca tca gct att cta atg gga Tyr Leu Gln Tyr His Thr Tyr Tyr Leu Pro Ser Ala Ile Leu Met Gly 145 150 155 160	480
gtt gcg tgg caa caa ttg gga tgg tta atc cat gaa ttc gca cat cat Val Ala Trp Gln Gln Leu Gly Trp Leu Ile His Glu Phe Ala His His 165 170 175	528
cag ttg ttc aaa aac aga tac tac aat gat ttg gcc agc tat ttc gtt Gln Leu Phe Lys Asn Arg Tyr Tyr Asn Asp Leu Ala Ser Tyr Phe Val 180 185 190	576
gga aac ttt tta caa gga ttc tca tct ggt ggt tgg aaa gag cag cac Gly Asn Phe Leu Gln Gly Phe Ser Ser Gly Gly Trp Lys Glu Gln His 195 200 205	624
aat gtg cat cac gca gcc aca aat gtt gtt gga cga gac gga gat ctt Asn Val His His Ala Ala Thr Asn Val Val Gly Arg Asp Gly Asp Leu 210 215 220	672
gat tta gtc cca ttc tat gct aca gtg gca gaa cat ctc aac aat tat Asp Leu Val Pro Phe Tyr Ala Thr Val Ala Glu His Leu Asn Asn Tyr 225 230 235 240	720
tct cag gat tca tgg gtt atg act cta ttc aga tgg caa cat gtt cat Ser Gln Asp Ser Trp Val Met Thr Leu Phe Arg Trp Gln His Val His 245 250 255	768
tgg aca ttc atg tta cca ttc ctc cgt ctc tcg tgg ctt ctt cag tca Trp Thr Phe Met Leu Pro Phe Leu Arg Leu Ser Trp Leu Leu Gln Ser 260 265 270	816
atc att ttt gtt agt cag atg cca act cat tat tat gac tat tac aga Ile Ile Phe Val Ser Gln Met Pro Thr His Tyr Tyr Asp Tyr Tyr Arg 275 280 285	864
aat act gcg att tat gaa cag gtt ggt ctc tct ttg cac tgg gct tgg	912

Asn Thr Ala Ile Tyr Glu Gln Val Gly Leu Ser	Leu His Trp Ala Trp		
290	295	300	
tca ttg ggt caa ttg tat ttc cta ccc gat tgg tca act aga ata atg			960
Ser Leu Gly Gln Leu Tyr Phe Leu Pro Asp Trp Ser Thr Arg Ile Met			
305	310	315	320
ttc ttc ctt gtt tct cat ctt gtt gga ggt ttc ctg ctc tct cat gta			1008
Phe Phe Leu Val Ser His Leu Val Gly Gly Phe Leu Leu Ser His Val			
325	330	335	
gtt act ttc aat cat tat tca gtg gag aag ttt gca ttg agc tcg aac			1056
Val Thr Phe Asn His Tyr Ser Val Glu Lys Phe Ala Leu Ser Ser Asn			
340	345	350	
atc atg tca aat tac gct tgt ctt caa atc atg acc aca aga aat atg			1104
Ile Met Ser Asn Tyr Ala Cys Leu Gln Ile Met Thr Thr Arg Asn Met			
355	360	365	
aga cct gga aga ttc att gac tgg ctt tgg gga ggt ctt aac tat cag			1152
Arg Pro Gly Arg Phe Ile Asp Trp Leu Trp Gly Gly Leu Asn Tyr Gln			
370	375	380	
att gag cac cat ctt ttc cca acg atg cca cga cac aac ttg aac act			1200
Ile Glu His His Leu Phe Pro Thr Met Pro Arg His Asn Leu Asn Thr			
385	390	395	400
gtt atg cca ctt gtt aag gag ttt gca gca gca aat ggt tta cca tac			1248
Val Met Pro Leu Val Lys Glu Phe Ala Ala Ala Asn Gly Leu Pro Tyr			
405	410	415	
atg gtc gac gat tat ttc aca gga ttc tgg ctt gaa att gag caa ttc			1296
Met Val Asp Asp Tyr Phe Thr Gly Phe Trp Leu Glu Ile Glu Gln Phe			
420	425	430	
cga aat att gca aat gtt gct gct aaa ttg act aaa aag att gcc tag			1344
Arg Asn Ile Ala Asn Val Ala Ala Lys Leu Thr Lys Lys Ile Ala			
435	440	445	

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Gly Lys Trp Cys Gln Ile Asp Asp Ala Val Leu Arg Ser His Pro Gly			
20	25	30	
Gly Ser Ala Ile Thr Thr Tyr Lys Asn Met Asp Ala Thr Thr Val Phe			
35	40	45	
His Thr Phe His Thr Gly Ser Lys Glu Ala Tyr Gln Trp Leu Thr Glu			
50	55	60	

Leu Lys Lys Glu Cys Pro Thr Gln Glu Pro Glu Ile Pro Asp Ile Lys  
 65                    70                    75                    80  
  
 Asp Asp Pro Ile Lys Gly Ile Asp Asp Val Asn Met Gly Thr Phe Asn  
 85                    90                    95  
  
 Ile Ser Glu Lys Arg Ser Ala Gln Ile Asn Lys Ser Phe Thr Asp Leu  
 100                    105                    110  
  
 Arg Met Arg Val Arg Ala Glu Gly Leu Met Asp Gly Ser Pro Leu Phe  
 115                    120                    125  
  
 Tyr Ile Arg Lys Ile Leu Glu Thr Ile Phe Thr Ile Leu Phe Ala Phe  
 130                    135                    140  
  
 Tyr Leu Gln Tyr His Thr Tyr Tyr Leu Pro Ser Ala Ile Leu Met Gly  
 145                    150                    155                    160  
  
 Val Ala Trp Gln Gln Leu Gly Trp Leu Ile His Glu Phe Ala His His  
 165                    170                    175  
  
 Gln Leu Phe Lys Asn Arg Tyr Tyr Asn Asp Leu Ala Ser Tyr Phe Val  
 180                    185                    190  
  
 Gly Asn Phe Leu Gln Gly Phe Ser Ser Gly Gly Trp Lys Glu Gln His  
 195                    200                    205  
  
 Asn Val His His Ala Ala Thr Asn Val Val Gly Arg Asp Gly Asp Leu  
 210                    215                    220  
  
 Asp Leu Val Pro Phe Tyr Ala Thr Val Ala Glu His Leu Asn Asn Tyr  
 225                    230                    235                    240  
  
 Ser Gln Asp Ser Trp Val Met Thr Leu Phe Arg Trp Gln His Val His  
 245                    250                    255  
  
 Trp Thr Phe Met Leu Pro Phe Leu Arg Leu Ser Trp Leu Leu Gln Ser  
 260                    265                    270  
  
 Ile Ile Phe Val Ser Gln Met Pro Thr His Tyr Tyr Asp Tyr Tyr Arg  
 275                    280                    285  
  
 Asn Thr Ala Ile Tyr Glu Gln Val Gly Leu Ser Leu His Trp Ala Trp  
 290                    295                    300  
  
 Ser Leu Gly Gln Leu Tyr Phe Leu Pro Asp Trp Ser Thr Arg Ile Met  
 305                    310                    315                    320  
  
 Phe Phe Leu Val Ser His Leu Val Gly Gly Phe Leu Leu Ser His Val  
 325                    330                    335  
  
 Val Thr Phe Asn His Tyr Ser Val Glu Lys Phe Ala Leu Ser Ser Asn  
 340                    345                    350  
  
 Ile Met Ser Asn Tyr Ala Cys Leu Gln Ile Met Thr Thr Arg Asn Met  
 355                    360                    365

Arg Pro Gly Arg Phe Ile Asp Trp Leu Trp Gly Gly Leu Asn Tyr Gln  
 370 375 380

Ile Glu His His Leu Phe Pro Thr Met Pro Arg His Asn Leu Asn Thr  
 385 390 395 400

Val Met Pro Leu Val Lys Glu Phe Ala Ala Ala Asn Gly Leu Pro Tyr  
 405 410 415

Met Val Asp Asp Tyr Phe Thr Gly Phe Trp Leu Glu Ile Glu Gln Phe  
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Arg Asn Ile Ala Asn Val Ala Ala Lys Leu Thr Lys Lys Ile Ala  
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ttg agg cta cga acg tcg aat tca aag ggt ccc gaa caa gag caa act 96  
Leu Arg Leu Arg Thr Ser Asn Ser Lys Gly Pro Glu Gln Glu Gln Thr  
 20 25 30

ttg aag aag tac acc ctt gaa gat gtc agc cgc cac aac acc cca gca 144  
Leu Lys Lys Tyr Thr Leu Glu Asp Val Ser Arg His Asn Thr Pro Ala  
 35 40 45

gat tgt tgg ttg gtg ata tgg ggc aaa gtc tac gat gtc aca agc tgg 192  
Asp Cys Trp Leu Val Ile Trp Gly Lys Val Tyr Asp Val Thr Ser Trp  
 50 55 60

att ccc aat cat ccg ggg ggc agt ctc atc cac gta aaa gca ggg cag 240  
Ile Pro Asn His Pro Gly Gly Ser Leu Ile His Val Lys Ala Gly Gln  
 65 70 75 80

gat tcc act cag ctt ttc gat tcc tat cac ccc ctt tat gtc agg aaa Asp Ser Thr Gln Leu Phe Asp Ser Tyr His Pro Leu Tyr Val Arg Lys 85 90 95	288
atg ctc gcg aag tac tgt att ggg gaa tka gta ccg tct gct ggt gat Met Leu Ala Lys Tyr Cys Ile Gly Glu Xaa Val Pro Ser Ala Gly Asp 100 105 110	336
gac aag ttt aag aaa gca act ctg rag tat gca gat gcc gaa aat gaa Asp Lys Phe Lys Lys Ala Thr Leu Xaa Tyr Ala Asp Ala Glu Asn Glu 115 120 125	384
gat ttc tat ttg gtt gtg aag caa cga gtt gaa tct tat ttc aag agt Asp Phe Tyr Leu Val Val Lys Gln Arg Val Glu Ser Tyr Phe Lys Ser 130 135 140	432
aac aag ata aac ccc caa att cat cca cat atg atc ctg aag tca ttg Asn Lys Ile Asn Pro Gln Ile His Pro His Met Ile Leu Lys Ser Leu 145 150 155 160	480
ttc att ctt ggg gga tat ttc gcc agt tac tat tta gcg ttc ttg Phe Ile Leu Gly Gly Tyr Phe Ala Ser Tyr Tyr Leu Ala Phe Phe Trp 165 170 175	528
tct tca agt gtc ctt gtt tct ttg ttt ttc gca ttg tgg atg ggg ttc Ser Ser Ser Val Leu Val Ser Leu Phe Phe Ala Leu Trp Met Gly Phe 180 185 190	576
ttc gca gcg gaa gtc ggc gtg tcg att caa cat gat gga aat cat ggt Phe Ala Ala Glu Val Gly Val Ser Ile Gln His Asp Gly Asn His Gly 195 200 205	624
tca tac act aaa tgg cgt ggc ttt gga tat atc atg gga gcc tcc cta Ser Tyr Thr Lys Trp Arg Gly Phe Gly Tyr Ile Met Gly Ala Ser Leu 210 215 220	672
gat cta gtc gga gcc agt agc ttc atg tgg aga cag caa cac gtt gtg Asp Leu Val Gly Ala Ser Ser Phe Met Trp Arg Gln Gln His Val Val 225 230 235 240	720
gga cat cac tcg ttt aca aat gtg gac aac tac gat cct gat att cgt Gly His His Ser Phe Thr Asn Val Asp Asn Tyr Asp Pro Asp Ile Arg 245 250 255	768
gtg aaa gat cca gat gtc agg agg gtt gcg acc aca caa cca aga caa Val Lys Asp Pro Asp Val Arg Arg Val Ala Thr Thr Gln Pro Arg Gln 260 265 270	816
tgg tat cat gcg tat cag cat atc tac ctg gca gta tta tat gga act Trp Tyr His Ala Tyr Gln His Ile Tyr Leu Ala Val Leu Tyr Gly Thr 275 280 285	864
cta gct ctt aag agt att ttt cta gat gat ttc ctt gcg tac ttc aca Leu Ala Leu Lys Ser Ile Phe Leu Asp Asp Phe Leu Ala Tyr Phe Thr 290 295 300	912

gga tca att ggc cct gtc aag gtg gcg aaa atg acc ccc ctg gag ttc Gly Ser Ile Gly Pro Val Lys Val Ala Lys Met Thr Pro Leu Glu Phe 305 310 315 320	960
aac atc ttc ttt cag gga aag ctg cta tat gcg ttc tac atg ttc gtg Asn Ile Phe Phe Gln Gly Lys Leu Leu Tyr Ala Phe Tyr Met Phe Val 325 330 335	1008
ttg cca tct gtg tac ggt gtt cac tcc gga gga act ttc ttg gca cta Leu Pro Ser Val Tyr Gly Val His Ser Gly Gly Thr Phe Leu Ala Leu 340 345 350	1056
tat gtg gct tct cag ctc att aca ggt tgg atg tta gct ttt ctt ttt Tyr Val Ala Ser Gln Leu Ile Thr Gly Trp Met Leu Ala Phe Leu Phe 355 360 365	1104
caa gta gca cat gtc gtg gat gat gtt gca ttt cct aca cca gaa ggt Gln Val Ala His Val Val Asp Asp Val Ala Phe Pro Thr Pro Glu Gly 370 375 380	1152
ggg aag gtg aag gga gga tgg gct gca atg cag gtt gca aca act acg Gly Lys Val Lys Gly Gly Trp Ala Ala Met Gln Val Ala Thr Thr Thr 385 390 395 400	1200
gat ttc agt cca cgc tca tgg ttc tgg ggt cat gtc tct gga gga tta Asp Phe Ser Pro Arg Ser Trp Phe Trp Gly His Val Ser Gly Gly Leu 405 410 415	1248
aac aac caa att gag cat cat ctg ttt cca gga gtg tgc cat gtt cat Asn Asn Gln Ile Glu His His Leu Phe Pro Gly Val Cys His Val His 420 425 430	1296
tat cca gcc att cag cct att gtc gag aag acg tgc aag gaa ttc gat Tyr Pro Ala Ile Gln Pro Ile Val Glu Lys Thr Cys Lys Glu Phe Asp 435 440 445	1344
gtg cct tat gta gcc tac cca act ttt tgg act gcg ttg aga gcc cac Val Pro Tyr Val Ala Tyr Pro Thr Phe Trp Thr Ala Leu Arg Ala His 450 455 460	1392
ttt gcg cat ttg aaa aag gtt gga ttg aca gag ttt cgg ctc gat ggc Phe Ala His Leu Lys Lys Val Gly Leu Thr Glu Phe Arg Leu Asp Gly 465 470 475 480	1440
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Leu Lys Lys Tyr Thr Leu Glu Asp Val Ser Arg His Asn Thr Pro Ala  
35 40 45  
Asp Cys Trp Leu Val Ile Trp Gly Lys Val Tyr Asp Val Thr Ser Trp  
50 55 60  
Ile Pro Asn His Pro Gly Gly Ser Leu Ile His Val Lys Ala Gly Gln  
65 70 75 80  
Asp Ser Thr Gln Leu Phe Asp Ser Tyr His Pro Leu Tyr Val Arg Lys  
85 90 95  
Met Leu Ala Lys Tyr Cys Ile Gly Glu Xaa Val Pro Ser Ala Gly Asp  
100 105 110  
Asp Lys Phe Lys Lys Ala Thr Leu Xaa Tyr Ala Asp Ala Glu Asn Glu  
115 120 125  
Asp Phe Tyr Leu Val Val Lys Gln Arg Val Glu Ser Tyr Phe Lys Ser  
130 135 140  
Asn Lys Ile Asn Pro Gln Ile His Pro His Met Ile Leu Lys Ser Leu  
145 150 155 160  
Phe Ile Leu Gly Gly Tyr Phe Ala Ser Tyr Tyr Leu Ala Phe Phe Trp  
165 170 175  
Ser Ser Ser Val Leu Val Ser Leu Phe Phe Ala Leu Trp Met Gly Phe  
180 185 190  
Phe Ala Ala Glu Val Gly Val Ser Ile Gln His Asp Gly Asn His Gly  
195 200 205  
Ser Tyr Thr Lys Trp Arg Gly Phe Gly Tyr Ile Met Gly Ala Ser Leu  
210 215 220  
Asp Leu Val Gly Ala Ser Ser Phe Met Trp Arg Gln Gln His Val Val  
225 230 235 240  
Gly His His Ser Phe Thr Asn Val Asp Asn Tyr Asp Pro Asp Ile Arg  
245 250 255  
Val Lys Asp Pro Asp Val Arg Arg Val Ala Thr Thr Gln Pro Arg Gln  
260 265 270

Trp Tyr His Ala Tyr Gln His Ile Tyr Leu Ala Val Leu Tyr Gly Thr  
275 280 285

Leu Ala Leu Lys Ser Ile Phe Leu Asp Asp Phe Leu Ala Tyr Phe Thr  
290 295 300

Gly Ser Ile Gly Pro Val Lys Val Ala Lys Met Thr Pro Leu Glu Phe  
305 310 315 320

Asn Ile Phe Phe Gln Gly Lys Leu Leu Tyr Ala Phe Tyr Met Phe Val  
325 330 335

Leu Pro Ser Val Tyr Gly Val His Ser Gly Gly Thr Phe Leu Ala Leu  
340 345 350

Tyr Val Ala Ser Gln Leu Ile Thr Gly Trp Met Leu Ala Phe Leu Phe  
355 360 365

Gln Val Ala His Val Val Asp Asp Val Ala Phe Pro Thr Pro Glu Gly  
370 375 380

Gly Lys Val Lys Gly Gly Trp Ala Ala Met Gln Val Ala Thr Thr Thr  
385 390 395 400

Asp Phe Ser Pro Arg Ser Trp Phe Trp Gly His Val Ser Gly Gly Leu  
405 410 415

Asn Asn Gln Ile Glu His His Leu Phe Pro Gly Val Cys His Val His  
420 425 430

Tyr Pro Ala Ile Gln Pro Ile Val Glu Lys Thr Cys Lys Glu Phe Asp  
435 440 445

Val Pro Tyr Val Ala Tyr Pro Thr Phe Trp Thr Ala Leu Arg Ala His  
450 455 460

Phe Ala His Leu Lys Lys Val Gly Leu Thr Glu Phe Arg Leu Asp Gly  
465 470 475 480